Standard Oil lab develops 'plant thermometer'

By MADELYN LEFKOWITZ

Standard Oil Co.'s Warrensville Research & Development Center puts a lot of its effort into advancing the company's knowledge of the oil and gas business. But a few of its researchers found time to develop a marketable product that will help farmers decide when to irrigate their fields.

The Scheduler plant stress monitor is a hand-held, computer-controlled device that measures plant conditions rather than soil conditions to determine whether or not a field needs water.

Scientists in the mid-1800s discovered that a healthy plant leaf with the proper amount of moisture is a few degrees cooler than the surrounding air. There were no quick, accurate techniques for measuring leaf temperatures, however, until the federal government developed infra-red thermometry during World War II to identify objects at night.

But in 1984, the Warrensville lab hired Bronson R. Gardner in 1984, who had measured plant conditions as part of his Ph.D research at the University of Nebraska. Gardner, a senior R&D chemist, and Melvin E. Keener, a research associate at the lab who had done some work of his own on infra-red thermometry at the University of Missouri, convinced corporate management that research into the measurement of plant conditions was worth pursuing.

Things moved quickly after the decision to go ahead was made. Large-scale field tests were conducted that same year. The following year 25 prototypes were tested. And this year pre-commercial units were test marketed, and the "project" became a new business venture within Standard Oil Engineered Materials Co., a division of Standard Oil. The division's corporate headquarters are in Niagara Falls, N.Y., but the new business venture is in Solon, not far from the Warrensville Research Center.

At the Warrensville center, research is done in catalysis, advanced materials, exploration and production of oil and gas, and biotechnology.

When asked the cost of developing the Scheduler, business manager Steven C. DeSutter said only that it was "millions" and added that the group was fortunate to have the resources of a large corporation behind it.

"Standard Oil provided the environment that allowed people to stretch, create something and get it to market," he said.

DeSutter, an agricultural economist, grew up on a midwestern farm. He said this background was helpful, especially in discussing modifications with farmers who field-tested the prototypes.

Decreasing the weight of the measuring tool and battery pack was a major modification. The prototype weighed 25 pounds; the current model weighs only six pounds. Also, the computer screen had to be made more readable in bright sunlight, and computer operations had to be simplified.

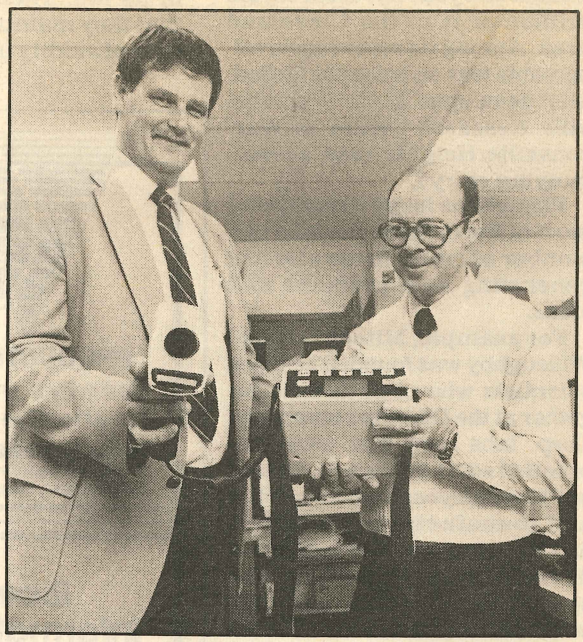


Photo by Doug Konkol

Melvin Keener and Bronson Gardner, of Standard Oil Co.'s Warrensville research center, developed the hand-held Scheduler to help farmers decide when to irrigate their fields.

In the present format, information from the sensor gun is automatically sent to a microcomputer when a trigger is pressed. Charts are simultaneously developed. These show conditions in each field over a 15-day period and signal a developing problem before damage can be detected in other ways. The device will even find a break in an irrigation line which shows up as a very wet area.

The primary market for the Scheduler is large agribusinesses and smaller farms that produce high-value crops such as wine grapes and strawberries. Each unit sells for $4,200.

There is demand for such a tool where water is scarce. By enabling the farmer to avoid both over-watering and under-watering, the Scheduler helps conserve water and prevent plant disease.

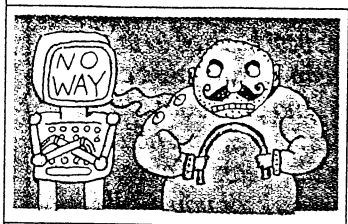
Test marketing has been done mainly in the Great Plains states, the irrigated grain area. In 1987 the target will be West Coast areas that grow specialty crops, mainly California's dry central valley, where the crops are grapes, potatoes, celery and head lettuce.

Crain's Cleveland Business
17 Nov. 1986.

Developments To Watch

EDITED BY SANA SIWOLOP

SOFTWARE THAT COULD SAVE CARMAKERS A LOT OF STEEL



The sleek appearance of today's cars, aircraft, and major appliances may seem to come straight out of a designer's sketchbook, but in reality the final shape is almost always a compromise. Not everything that designers dream up can be stamped from metal. That's one reason the auto companies spend months building and rebuilding models of new cars—to help determine whether a flat sheet of steel can be pounded into the desired shape.

But General Electric Co. thinks it has an alternative to the costly trial-and-error process of "proving out" a design with successive prototypes. Researchers at GE's R&D center in Schenectady, N. Y., have developed a computer "expert system" that tells engineers almost instantly whether a design can be manufactured efficiently. This software, called Sheets, can analyze a designer's work while it is still on the video screen of a computer-aided design (CAD) system. So far, the computer program has been used only to test the manufacturability of relatively simple shapes, but Chrysler Motors Corp. is joining GE's Major Appliance Business Group to help refine Sheets for real-world applications.

A HIGH-TECH DEVICE THAT POINTS OUT PARCHED PLANTS

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Point the Scheduler at a stalk of corn or wheat, and a gang of infrared sensors takes readings of air temperature and humidity, the intensity of sunlight, and the plant's temperature. A microcomputer in the instrument indicates whether the crop needs water. Although the computer has to be programmed for each crop, it can be used on virtually any kind of plant. Moreover, it can store data on up to 30 different fields for up to two weeks. Standard says that grain farmers who tested the high-tech product last summer saved so much money they can't wait for it to reach the market next spring. The company, however, says variables are too complex to predict what the savings would be. But with Scheduler priced at $4,200, the figures had better not be peanuts.

PLASTICS MAY GIVE SILICON A RUN FOR ITS MONEY

Plastics may be the surprise material for tomorrow's superfast computers. Scientists at AT&T Bell Laboratories are developing a new generation of computers that use light instead of electrical signals. And instead of chips made from silicon, one group of researchers is working on optical transistors, or switches, made with polydiacetylene, a polymer that has "very dramatic optical properties," according to Benjamin I. Greene, a staff scientist.

Under certain conditions, the polymer will form crystalline structures that are ultrasensitive to light. Bell Labs is wagering that this property can be harnessed for optical transistors capable of processing laser-beam signals with incredible speed—more than 1,000 times faster than silicon transistors can process electrical signals. In fact, Bell Labs will soon file for a patent on this application.

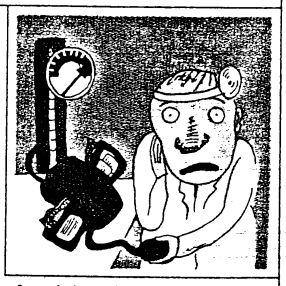
The big question remaining is whether it's possible to grow commercial polydiacetylene crystals that are pure enough. One reason silicon is the preferred material for chips is that crystals can be made 99.999999% pure. Semiconductor scientists have virtually ignored polymers because they are so "messy," Greene notes. "So some of the bizarre effects you can get in organic materials will be a real surprise to a lot of physicists."

RESEARCH LABS WILL GET CREDIT WHERE IT'S DUE

This year the federal government plans to hand out more than $60 billion in research and development funds. But science officials admit they know surprisingly little about the technical abilities of the 12,000 laboratories in the U. S. that spend the money. And they are not certain that their research funds are going to the labs best suited for the assignment. So they are mounting a study to assess the talents of the nation's academic, government, and industrial labs.

Working under a contract from the National Science Foundation, researchers at Syracuse University plan to scrutinize the 200 largest labs and take a random sample of an additional 1,500. They want to learn how R&D is planned, organized, and managed. And they will try to figure out how rapid shifts in government spending priorities change the U. S. technological base. "If we understand the labs' competencies, then we can get a better idea of who will spend R&D most effectively in specific areas," says Barry L. Bozeman, director of the Technology & Information Policy Program at Syracuse.

A PINCHED PURSE MAKES THE BLOOD PRESSURE HIGHER



Financial setbacks don't just hurt in the pocketbook—they affect health as well. Researchers at Johns Hopkins University in Baltimore have found that when income drops, blood pressure rises.

The researchers studied 1,130 graduates of the university's medical school. They discovered that a 10% decrease in income for one year caused up to a 27% increase in the physicians' incidence of hypertension, or high blood pressure, in the following year. The doctors were an ideal group for studying the effect of economic setbacks on health. As a group, they are more inclined than the general public to avoid such hypertension and heart disease risk factors as smoking and eating fatty foods. Although doctors' incomes have increased about 40% faster than those of the general population since 1948, they also fluctuate much more, says Hopkins economist Robert Swank. "Unlike doctors, most Americans haven't seen income declines of 10% or more since the Great Depression," he says. "Even recession years bring drops of only 1% to 2%." Next, the researchers want to see whether income drops increase the incidence of other forms of heart disease, as well as cancer.

ILLUSTRATIONS BY PHILIP ANDERSON

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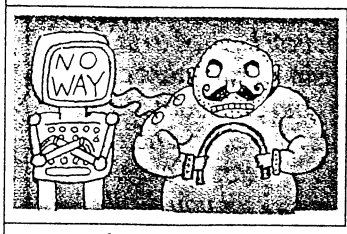

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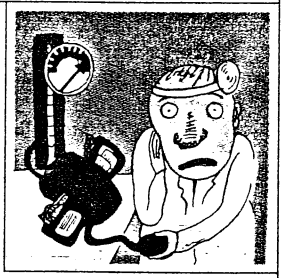

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ILLUSTRATIONS BY PHILIP ANDERSON

S.A. Livestock

SAN ANTONIO (AP) — Cattle 2,000. Compared with last Wednesday: Feeder steers,bulls and heifers steady to weak. Slaughter cows 1.00-1.50 lower. Slaughter bulls not tested early. Demand fair.

Feeder steers: Medium & large frame No. 1: 400-500 lbs. 64.00-66.00.

Feeder bulls: Medium & large frame No. 2: 300-400 lbs. 62.00-67.00, 400-500 lbs. 58.00-64.00,550-700lbs.52.75-54.25. Large frame No. 2 Santa Gertrudis: 400-500 lbs. 56.25-58.25, 500-800 lbs.47.75-53.75.

Feeder heifers: Medium & large frame No. 1: 400-500 lbs. 53.00-57.25. Medium & large frame No. 2: 300-400 lbs. 56.00-62.50, 400-500 lbs. 53.50-57.00; 500-600;lbs.55.25-59.00; 600-700 lbs.50.25-52.25. Large frame No. 2 Santa Gertrudis: 300-400 lbs. 57.00-59.50, 450-650 lbs.49.75-52.25.

Replacement cows: Large frame No. 2 700-950 lbs. 42.50-46.50.

Slaughter cows: Boning utility 1-3 37.50-39.00, low dressing 33.50-34.50.

Hogs: 400. Compared to last Monday: Barrows and gilts .50-.75 higher.

Barrows and gilts: U.S. 1-3, 210-260 lbs, 53.75-54.00, 25 head 54.50.

Sows: Steady. U.S. 1-3, 300-600 lbs, 48.00-49.00.

K.C. Livestock

KANSAS CITY, Mo. (AP) — Quotations for Monday: Hogs 600: Barrows and gilts 1.00 higher; 1-3 210-260 lb 55.00-55.50; 2-3 260-280 lb 53.50-54.50. Sows under 500 lb 50-75 higher, over 500 lb 1.50-2.00 higher; 1-2 300-500 lb 45.00-45.50; 1-3 over 500 lb 45.50-46.00.

Staple Prices

NEW YORK (AP) — The Associated Press weighted wholesale price index of 35 commodities Monday 533.66,previous day 533.34, week ago 529.24, month ago 517.26, year ago 519.38.

	1986	1985	1984	1983
High	536.88	534.54	568.49	538.15
Low	506.15	513.27	520.56	478.57

(1926 average equals 100)

Cash Grain

SPRINGFIELD, Ill. (AP) — Truck and rail bids for grain delivered to Chicago. Quotations from the USDA represent bids from terminal elevators, processors, mills and merchandisers after 1:30 p.m. Central time.

	Fri.	Thu.
No. 2 Soft wheat	2.80	2.73½
No. 1 Yellow soybeans	4.97½	4.92¾
No. 2 Yellow Corn	1.71¾p	1.70¾
No. 2 Yellow Corn	1.63	e n.a.

p-processor bids.
e-terminal elevator bids.
n.a.-not quoted.
r-revised.

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Cheap water cuts use of advances

Irrigation convention opens here

High-tech advances in irrigation can vastly improve water conservation — but their acceptance depends more on water costs, an industry official said Monday at a worldwide irrigation convention in San Antonio.

The convention of the Irrigation Association, co-sponsored by U.S. and Mexican irrigation associations, continues through Thursday at the Convention Center.

The convention has drawn an estimated 3,500 representatives and 250 exhibitors from the agriculture and landscaping industries, said Raymon York, Irrigation Association president.

York said in an interview that the agricultural irrigation industry is struggling along with farmers themselves, while the landscape irrigation industry has grown in the past two years.

'Very cheap water'

Water in the West and Southwest is in short supply. Nevertheless, York said, as a nation "we've had very cheap water."

York said this year's convention theme is "Irrigation and the Environment."

"Our whole theme in irrigation is, through good irrigation practices you conserve two precious resources: energy and water."

He added, "We just encourage the general public to be more efficient, and we try to educate the political portion of our society to the fact that water use — like energy use a few years ago — isn't something you get a great response to by edict."

Economic factors such as water pricing probably provide a more realistic means of allocating scarce water supplies than legislative edict, he said.

York said research has developed sophisticated technological devices for measuring and monitoring irrigation.

Expensive devices

However, York said those devices are expensive, adding, "As long as water is cheap there is no economic incentive to use it.

"The real issue, I suppose, is economics," he said.

Among technological advances in irrigation, York mentioned that the organization's 1986 Man of the Year, Dr. William Lyle of the Texas Agricultural Experiment Station in Ralls, improved center-pivot irrigation systems to an efficiency rating of 99.9 percent, "which is actually higher than rainfall, if you can believe that."

By comparison, pivot systems of the mid-1970s averaged 85 percent efficiency.

Also, Lyle has reduced energy costs by as much as 90 percent, York said.

"So he's made them both 15 percent more efficient, and he can get 10 times the production per dollar of investment," he said.

At the industry trade show, Standard Oil representative Steve DeSutter demonstrated a computerized infrared device that helps farmers determine when and how much to irrigate by reading plant temperatures and computing the water stress level.

DeSutter said the hand-held device, due to be marketed next April, will cost $4,200.

However, he said a 1,000-acre grower could earn its cost back twice in the first season by only cutting irrigation water usage by two inches.

Hanan Raban, of the Ramat David Metal Works in Israel, said his firm is searching for an American manufacturer for a new, 660-foot-long irrigation machine that is propelled by water pressure.

An on-board computer meters flow and monitors the machine's speed across a field to deliver precise amounts of water to a crop.

Photo by JOE FOHN

STANDARD OIL REPRESENTATIVE STEVE DESUTTER . . . demonstrates infrared device for use in irrigation

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slump in history, completing the cartel's slow surrender of the power to dictate oil prices.

On Thursday the cartel leaders return to Geneva to debate ways of recapturing the initiative in a glutted market.

Boxed into a corner by ever-declining oil demand and its own lack of cohesion, OPEC declared on Dec. 9, 1985 that it would stop trying to prop up prices by limiting members' crude oil production.

A price war was on. By March prices had tumbled below $15 a barrel from nearly $30 in early December. Prices bottomed out in July at below $10 a barrel and now are near $15.

Thursday meeting

When they reconvene Thursday for their sixth meeting this year, the 13 oil ministers of the Organization of Petroleum Exporting Countries will be searching for a common strategy to drive prices back to at least $18 a barrel.

They have given up the price war approach, but face long odds in trying to reverse the damage it inflicted on the world oil industry.

OPEC's decision a year ago was none of the cartel leaders' doing. Prices would fall as far as they did. By March, many of them were calling for an end to the price war and a return to production quotas.

At Iran's initiative, OPEC quotas were reinstated on a temporary basis last August, renewed in October and are due to expire at the end of December.

Iran is expected to propose another temporary system of production limits and possibly an across-the-board cut in output.

By triggering this year's price collapse, OPEC won a measure of support from Norway, which is withholding 10 percent of its oil exports from the market, and Mexico. But it has not been enough to end the oil slump or put OPEC back in control.

Cost $35 billion in '86

In the meantime, the halving of oil prices has cost OPEC at least $35 billion in lost oil income this year alone, according to its own estimates.

The cartel expects to earn about $65 billion this year — its lowest total since 1974. Just six years ago OPEC's income topped $275 billion.

FARM & RANCH REPORT

Permits issued for 1 million cattle to cross border

A lot of cattle are crossing the border from Mexico as ranchers over there take advantage of government permits allowing the export of more than 1 million cattle, mostly feeder steers and bulls.

"They've issued 1,070,000 permits for the total frontier," said Dr. H.Q. Sibley, a U.S. Department of Agriculture veterinarian at the Laredo port of entry. That issue came in early October, he said.

If those get used up, the Mexican government is prepared to issue 70 percent of that total next February, Sibley said.

In the Laredo sector, which covers most of Tamaulipas and Nuevo Leon, 1,988 cattle passed through in October. In November, however, the total jumped to 12,016 and this month should top that, USDA officials said.

"We've got 3,000 to 4,000 head in the pens right now," said Sibley, who added that crossings at Presidio, Del Rio and Eagle Pass should top Laredo's figure.

"El Paso's liable to cross 50,000," he said.

"The cattle this year are fat," he said. "They're coming from Oklahoma feedlots, desert pastures, Panhandle wheat fields and Southeast and Northeast Texas oat fields, he said.

Joe Fohn
Cattle Clatter

"I don't know what effect it's having on our market over here, but it's bound to have some effect," said Couger did say, however, that while this is traditionally a heavy season for crossing Mexican cattle, "I haven't seen it like this in the four or five years I've been here."

The domestic cattle inventory is expected to show a 20-year low when a federal report is released in January, so United States may be shorter on feeder cattle than usual and thus able to absorb the influx, Couger said.

However, he said there's little likelihood of that happening.

He said that even though Mexico may have issued permits for 1.07 million cattle to cross in its fiscal year that ends Aug. 31, 1987, "I'm saying they won't get 600,000 cattle out of there."

Anyway, Light said, the U.S. holds a favorable balance of trade over Mexico in terms of beef tonnage.

'Sun Gun' irrigation Scheduler wins farmers' attention

Outside Steve Bauer's office a group of farmers milled around and discussed the weather and the corn crop.

Occasionally they would glance at Steven DeSutter, product manager of a new infrared gizmo. No one ventured inside.

DeSutter finally stuck his head through the door to call the group inside the Kimmes-Bauer irrigation dealership south of Hastings, MN. What followed was an exercise that went from sci-fi to reality to hands-on as technology put atmosphere into an understandable, computerized and usable chart.

Irrigate today, or wait? That is what the Scheduler, a product of Standard Oil of Ohio (SOHIO), helps to decide, and what DeSutter was there to demonstrate. The Scheduler Crop Stress Monitor is basically a hand-held weather station, meshing infrared thermometry with the calculations of the Crop Water Stress Index. It has 14-day memory capacity, charting capability, and can provide a 30-reading field average instantly. And, it can be downloaded into a personal computer for permanent storage.

"Irrigation decisions are made on economics and experience. Economics may include system capacity, water availability, power and input costs and profit factors. Experience takes in prevailing weather patterns, crop growing stages and characteristics, yield reducing conditions and soil characteristics. What has been missing is knowing the actual condition of the crop," he said.

Then he brought out the small "gun" shaped Scheduler. As he talked, the group eyed the gun and its microprocessor. "Infrared thermometry measures crop canopy temperature. A healthy plant generally has a temperature a few degrees lower than the surrounding air. If you run your fingers over a plant on a hot day, the leaf is cooler than the surrounding air.

"As the crop becomes stressed, their stomates close. Leaf temperature rises relative to the surrounding air temperature and environment.

Steve DeSutter (left) instructs Steve Bauer on how to use the Scheduler.

This hotter leaf temperature is detected by infrared thermometry," he said.

The group then made a pickup parade to a nearby corn field. DeSutter first gave the Scheduler to Bauer, and then to each of the farmers. A cumulative reading of the crop canopy was made, which included plant temperature, relative humidity, and sunlight intensity. In a specific test, the group measured an obviously stressed or wilted corn plant against a very healthy one.

"You can read individual plants, or areas in a field that may show differing temperatures. These may show hot spots, differences in soil types, a lack of soil moisture or other factors that may cause higher plant temperatures," he said.

DeSutter said the Scheduler is the first such instrument to collect and give environmental information to a microprocessor, which makes instant, LED in-field plant stress calculations. The key is that the Scheduler can indicate stress long before it is visible to the naked eye, stresses that can cause yield reductions.

"You can keep each field at its optimum level and manage your irrigation for maximum efficiency and cost savings. You can use the graph to verify crop stress recovery. If the stress pattern doesn't show a downward trend after an irrigation, you may have other problems," he said.

These may be caused by the water delivery system, lack of nutrients, insects, or some other problems.

Growers can target irrigations to critical crop growth stages, or reduce unnecessary irrigations, saving water and power costs without a loss of yield. "This is especially critical where growers are juggling irrigation management around peak utility loads," he said.

As the Scheduler was passed from farmer to farmer, new questions were raised. Cost was a big one. "I doubt if a single farmer with one or two center pivots could justify a payback," he said, adding that this would depend on water, pumping and utility costs.

"But, a crop consultant, a cooperative, or a group of farmers could certainly show a payback, and individual farmers with five or more pivots would be included in that group," he said. Expected price: $4,200.

Another question: "According to what we've seen here," asked the farmer whose field was being surveyed, "should I irrigate today?"

"Your crop is right on the line. I would scan the field tomorrow and make the decision then," DeSutter answered.

He couldn't leave the demonstator model with the farmer, but the next day the pivot was up and running.

The following day it rained. ◊

96A-72 MONTANA FARMER-STOCKMAN
SEMI-MONTHLY 24,500

MARCH 5, 1987

CLIPPED BY Bacon's

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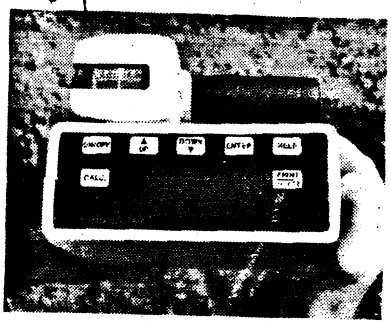

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I thought it was 5-10¢ per unit

96A-51 HIGH PLAINS JOURNAL
WEEKLY 56,500

MARCH 9, 1987

CLIPPED BY Bacon's

169

Scheduling irrigation is easy with stress monitor

Petersen and Son, Inc., an irrigation equipment distributor, Osmond, Neb., announces they have the distributing rights for the Scheduler. The Scheduler, a plant stress monitor, is a sophisticated but easy-to-use tool that allows maximum efficiency ~~in scheduling~~ irrigation.

The Scheduler, manufactured by Standard Oil of Ohio, is the first portable unit of its kind for determining crop stress. A computer calculates plant stress from the inputs provided by an infrared thermometer and sensors for air temperature, relative humidity, and sunlight intensity.

The infrared thermometer measures leaf temperature of the plant and incorporates the environmental factors into the computer and determines if the plant is under stress.

Growers can target irrigations to critical growth stages, or reduce unnecessary irrigation. Standard Oil's Dr. Bronson Gardner said, "An overwatering by two inches can result in a loss of 50 pounds of nitrogen in the soil."

The Scheduler is programmable for numerous crops. Stress indexes are developed for each crop because different plant species relate to the environment differently. "For each crop we have to know the 'baseline' or normal reading for a non-stressed crop," Gardner explained. "Departures from that baseline indicate some type of stress. Once the plant stress has been increased to a predetermined level, irrigation needs to begin."

Although the Scheduler is a powerful tool, it is extremely easy to use. Brian Barelmann, foreman for the Herd Company farming operation, Bartlett, Neb., said of the unit's user-friendliness; "It took me about 15 minutes to learn how to use the Scheduler." Barelmann used a Scheduler to monitor stress on corn under center pivot irrigation in the Sandhills of Nebraska.

The Scheduler allows the plant to tell growers when it needs water. Some farmers may be putting on too much water, and others may not be putting on enough. Better scheduling of irrigation can translate into higher yields and more efficient crop production.

Early insect infestation can also be found by the Scheduler. It will find infestation by showing an increase in the crop canopy temperature within a localized area of a field.

The Scheduler allows a person to monitor an area of up to 160 acres from one location. This can make checking pivots an easy job for a busy person. The Scheduler plant stress monitor gives the growers flexibility in managing their crops never before available.

13A-3 CERAMIC INDUSTRY
MONTHLY 7,100

MARCH 1987

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Ceramic fiber furnace lining systems, from *Fibers Div., Standard Oil Engineered Materials Co.*

For information circle **1**

13A-3 CERAMIC INDUSTRY
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Refractories for kiln cars, from *Refractories Div., Standard Oil Engineered Materials Co.*

For information circle **8**

96A-54 IDAHO FARMER-STOCKMAN
SEMI-MONTHLY 16,700

MARCH 5, 1987

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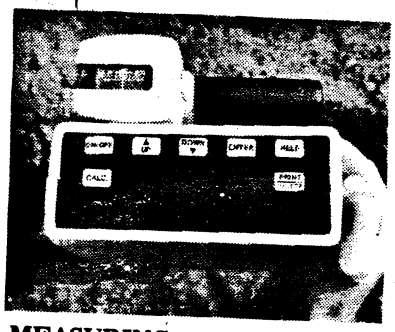

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96A-122 UTAH FARMER-STOCKMAN
SEMI-MONTHLY 7,400

MARCH 5, 1987

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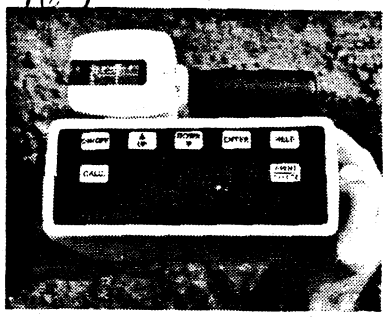

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SEMI-MONTHLY 25,600

MARCH 5, 1987

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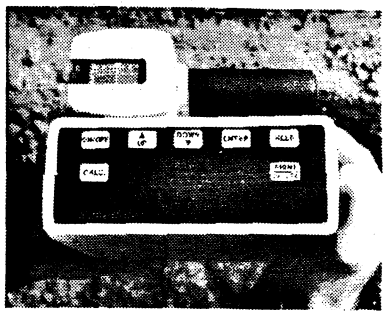

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96A-72 MONTANA FARMER-STOCKMAN
SEMI-MONTHLY 24,500

MARCH 5, 1987

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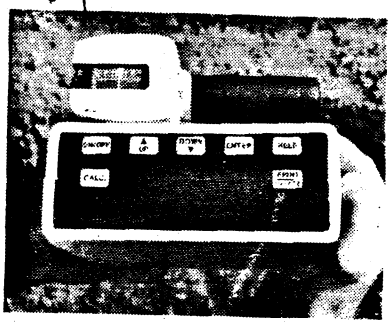

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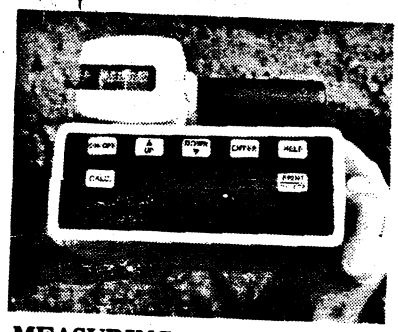

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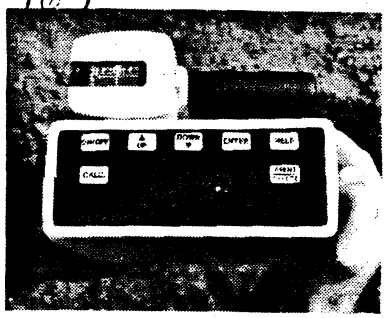

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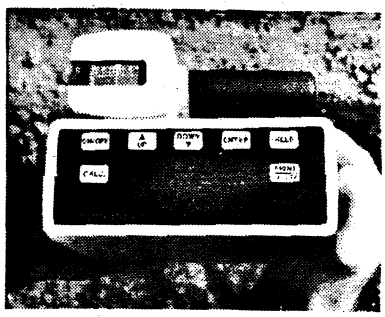

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STANDARD OIL
ENGINEERED MATERIALS

Memorandum

To: Distribution

Date: 6/22/87

From: L. F. Kahl

Copy to: LB CTS JKR BRG Return SCD

Subject:

You might have read the attached article that appeared in the Buffalo News edition of June 14, 1987.

In any event, this article tells, in a concise way, where we are coming from, and gives the general direction we are pursuing to map our future. It also gives a good picture of what happened to some of our major Carborundum divisions.

I thought you would enjoy reading it and maybe, if and when appropriate, sharing it with some of your distributors and customers.

I am sure Joe Forness will be glad to get you additional copies if needed.

attachment

THE BUFFALO NEWS
Business/Finance

Sunday, June 14, 1987

Carborundum's High-Tech Rebirth

By DAVID MONTGOMERY

Standard Oil Co. bought one of Niagara Falls' oldest companies in 1981 and set off a wrenching and confusing process of carving up, selling and reselling morsels of what was once the Carborundum Co.

Now a picture is emerging of just what Standard Oil has in mind for the thriving one-third of Carborundum that the Cleveland oil company deemed worth keeping. And few who saw the plant closings and divestitures would have predicted it: The overhauled Niagara Falls operation has little to do with the bulk of Carborundum's old specialties, but the high-technology future still has its roots in the business Carborundum invented almost a century ago.

The company now called the Standard Oil Engineered Materials Co., headquartered in the Carborundum Center in Niagara Falls, expects sales of $350 million in 1987. Worldwide employment is 5,000. Local employment is 800, down from the 3,339 employed by Carborundum a decade ago.

Luiz F. Kahl, a 26-year Carborundum veteran and president of Engineered Materials, says the company's future depends on so-called "high-tech ceramics" and advanced materials. Markets for some of these products hardly existed a decade ago.

"People still look at us as being the old Carborundum Co., which we're very proud of," Kahl said. "But today, we're different."

By 1983, Standard Oil had decided to quit the abrasives business, the core of the old Carborundum, serving a market that was shrinking. Admitted Kahl: "Our plants were not what you might call state-of-the-art. Our technologies were not what you might call the cutting edge of abrasives technology."

So local abrasives operations either were closed or sold. Then last year the Electro Minerals Division in Niagara Falls, not connected to Engineered Materials at the time, was sold by the Cleveland parent company, too.

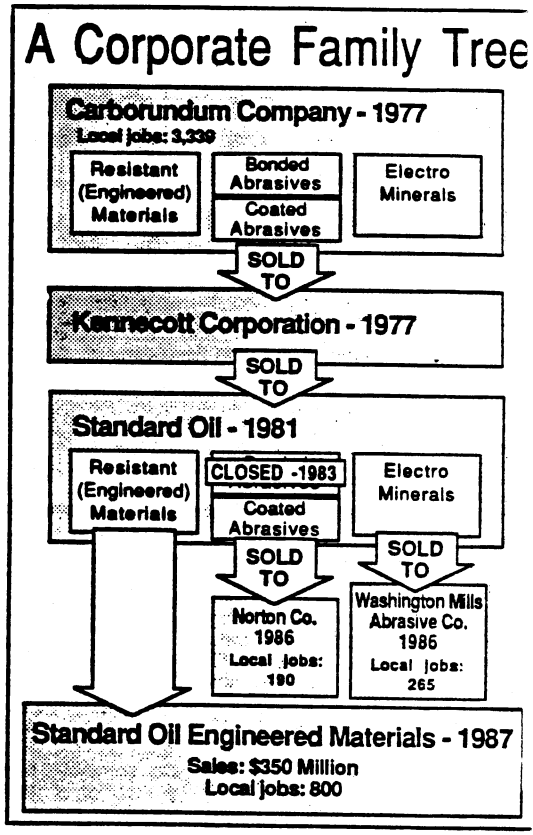
Now the process of trimming older and less promising parts of the longtime Niagara Falls operation is complete, according to Kahl.

"What we have screened in terms of profitability and technology has already taken place," he said. "We don't expect to see any divestitures, be it now or in the future."

Indeed, Engineered Materials appears to be settling into a spending and expansion mode. Over the last two years, the company has committed $22.6 million to new factory construction and new equipment purchases in Western New York. It is Standard Oil's biggest capital investment on the Niagara Frontier since taking over Kennecott Corp. (owner of Carborundum from 1977) in 1981.

Engineered Materials devotes 7 percent of sales to research and development, well ahead of the average for U.S. corporations. The work is split between a 100-person R&D staff in Niagara Falls and a 100-person staff near Cleveland.

From left, president Luis Kahl; vice president and general manager David Schultz, and process development manager Michael Matson demonstrate an extrusion process.



Kahl claims the hardest decision of his career was closing the old Carborundum bonded abrasives plant in Niagara Falls in 1983 and eliminating 650 local jobs. Still, he doesn't pretend that Engineered Materials will replace all the lost jobs any time soon. The new technologies use labor sparingly. Instead, they rely on science, expensive equipment and hydropower.

But by targeting fine ceramics and other advanced materials, Engineered Materials has set its sights on some of the most potentially profitable areas of materials research, relevant to everything from computer chips to car engines. If the company actually achieves its ambitions, it will enjoy an advanced materials market in a decade or two that experts predict will be huge.

"People don't associate us with aerospace, with ceramics ... but that's definitely where the majority of our business will be in the next 10 years," Kahl predicted.

Today, the majority of Engineered Materials' business is in slightly older technologies, inherited from Carborundum. The biggest-selling divisions are fibers and refractories, headquartered in Niagara Falls, with operations worldwide; and metaullics, headquartered outside Cleveland.

What executives call "older" materials today make up about 75 percent of sales.

For example, Engineered Materials' refractories division produces the lining for most of the blast furnaces in the world. The metaullics division provides many of the world's pumps for molten metals, such as aluminum. The Filon-Silmar division in California makes the fiberglass panels for recreation vehicles like the Winnebago, for green houses, and for patios.

In 10 years, Kahl said, older materials will make up just 25 percent of sales, and new materials, like electronic ceramics, structural ceramics and composites, will be 75 percent of sales.

The older areas' share won't shrink from cuts and layoffs. They will just fail to grow as quickly. They serve more mature markets, while the newer materials "are growing a heck of a lot faster," Kahl said.

Big things are expected from Engineered Materials' electronic ceramics division, one of the new materials areas. The division includes some former Carborundum lines, such as igniters for many major appliances. But Engineered Materials also is spending $8.5 million on new facilities in Amherst and Sanborn to help the division exploit some of the sexiest ceramics opportunities.

The Sanborn facility is developing a new product that is being described as the next generation in materials for anchoring silicon chips in computers, according to David L. Schultz, vice president and general manager of the electronics ceramics division. This chip support is called a substrate. If chips are the brains of computers, then substrates are part of the skull.

The problem: Most substrates on the market today are good electrical insulators, but they are poor at their other chore — shedding heat from the circuit. As computers get smaller, the heat part of the equation will become more critical, Schultz said.

The solution: Engineered Materials has come up with a way to use silicon carbide to anchor the chips, and let the heat slip away. The new substrate is still at the development stage. Right now, the giants in the substrate business are Japanese firms, and they too are researching improved substrates.

"It's clearly a horse race, but we think we're in a good position," Schultz said. "Our real strength is in our materials science."

After all, he pointed out, Engineered Materials researchers have been working

See Carbo: Page B-16, Column 1

David Dunn, director of business development, demonstrates The Scheduler, which tells when vegetation should be irrigated.

Carbo

Continued from Page B-15

with silicon carbide and its family of materials for decades longer than competitors. Silicon carbide was one of the first high-tech ceramics, and it was invented by Edwin G. Acheson in the 1890s for Carborundum.

Schultz said the electronics ceramics division is aiming to go from minimal start-up sales in so-called "high-performance" substrates to about $20 million within several years, controlling about one-third of the high-performance market.

A recently built $5 million plant in Niagara Falls is the headquarters of Engineered Materials' structural ceramics division, covering the other end of the ceramics spectrum. The division makes products, again often based on good old silicon carbide, that are better than metal at withstanding corrosion, heat, shock, or other stresses, according to Jonathan W. Hinton, vice president and general manager of the structural ceramics division.

The division makes seals that stop leaks anywhere from inside appliances to around shafts in submarines. Ceramic nozzles are used in sandblasting guns. Ceramic components go into heat exchangers. In addition, the division has contracts with two engine makers, including General Motors, to work on ceramic turbine engine projects for the Department of Energy.

In the past year Engineered Materials also has cast its eye on another kind of high-tech material that falls under the general name composites. These are super-light, strong, plastic, metal or ceramic materials that are often reinforced with fibers. They are used to make anything from tennis rackets to panels on the fanciest jet fighters.

Engineered Materials' R&D department has started hunting down opportunities in composites, according to Kahl.

For all these ventures, Kahl stresses how it all fits, how Engineered Materials is emerging with a unified identity. For instance, the refractories and fibers division already is adept at the kind of fibers that might be useful in composites. And the division is building a new $9.1 million ceramics fiber plant in the Town of Tonawanda. The Filon-Silmar division already is making composite-type products. The metaullics division makes many of its pumps out of ceramic products.

Meanwhile, a small business development division that functions as sort of an in-house business incubator, headed by David Dunn, is starting up new product lines. One of the latest is "the scheduler," a sensor that resembles a gun. You aim it at a crop or a golf green, and the scheduler measures the "stress" of the plant life and calculates when is the best time to irrigate. The sensor in the scheduler is partially based on ceramics technology.

Last year, Engineered Materials generated $36 million in operating income for the parent Standard Oil, up from $30 million in 1985. But in 1986, Engineered Materials pumped $25 million of that operating income back into new business development, deferring present profits for technological gains in the future.

While Engineered Materials is largely self-supporting, Standard Oil's deep pockets, technical resources and big reputation would be sorely missed.

"This big transformation (of Engineered Materials out of Carborundum) was possible basically because we had Standard Oil behind us," Kahl said.

"Would we (Carborundum) have struggled through it and survived (without Standard Oil)? Possibly we could have, but not in the position we are in today."

And probably the same cuts and layoffs would have been necessary, he said.

This month, the Niagara Falls materials operation is technically being bought again. British Petroleum is completing its purchase of Standard Oil stock, although BP already owned about 55 percent for some time.

Engineered Materials executives say they do not expect much change in the commitment to local operations, nor to investing in new plants and staying abreast of new technologies.

"I think we've learned a very good lesson from the abrasives era," Kahl said. "We had old plants that were very tired. We've come a long way."

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Financial stress moderates

By HEMBREE BRANDON
Farm Press Editorial Staff

WASHINGTON — As Congress returns from its summer recess to resume work on farm credit legislation, a recent USDA study indicates there may be some moderating of the financial stress that has burdened the nation's agricultural community for the past several years.

"Estimates of lenders' potential losses on farm loans, which peaked at $8.6 billion in 1985, are forecast to drop to $4 billion in 1987," according to the Economic Research Service report by Clark Edwards and Herb Moses.

Lenders now hold nearly eight million acres of farm land acquired through foreclosure and bankruptcy.

That represents less than one percent of all U.S. farm land.

"Although these holdings could be put on the market all at once, lenders are reluctant to sell their holdings rapidly lest prices fall," the report notes. "In addition, improving rates of return on farm land could boost values."

Values stabilizing

Edwards and Moses say their study indicates the value of real estate assets in the farm sector is stabilizing, and equity values may be edging up as a result of farm income being buoyed by increases in federal payments and reductions in cash expenses.

"Many farmers are paying off debts and acquiring less new short-term debt than in the past. But continued foreclosures and debt restructuring indicate not all farmers are sharing in the recovery."

When Congress cranks up its new assault later this month to ease the problems of the Farm Credit System, much of the debate is likely to focus on how to balance the rights of both borrowers and FCS shareholders, according to Farm Credit Administration Chairman Frank Naylor.

Knight-Ridder Financial Service says Naylor feels House and Senate discussions of the cost of an FCS bailout and how to insure borrower/shareholder rights will likely continue until legislation is completed, which could be late October or November.

Estimate difficult

Naylor says the existence of a number of open-ended expenses has made it difficult to estimate the final cost of any program to aid the loss-plagued system.

But regardless of the amount of money FCS will need to get back on sound financial footing, Naylor said the use of federal dollars must be monitored to insure that system institutions use the aid to improve their capital situation.

He suggested they will be required to improve handling of non-accural loans, adjust interest rates, and reduce operating costs.

Emphasizing that FCS is a cooperative, and that its shareholders must be protected along with its borrowers, Naylor says the price tag any assistance will carry will depend on how Congress weighs the need to protect borrowers against the costs to the shareholders.

Senate delay

While the House is expected to go ahead with its plans for floor action on farm credit legislation sometime this month, the Senate's version may sit on the back burner for a while as a result of hearings on the nomination of Judge Robert Bork to the Supreme Court.

Even though Senate Agriculture Committee members were reported to be in agreement on the legislation, Chairman Patrick Leahy has announced a suspension of work on the measure because he and other key senators will be involved in the Bork nomination hearings. There is no indication how long the Bork hearings will last.

Members of the Agriculture Committee said they would submit a consensus plan to the Subcommittee on Farm Credit, which was scheduled to meet Sept. 15.

Beat insects with scouting.

Forrest Laws receives ASA award

ST. LOUIS — Forrest Laws, associate editor and markets editor of the Delta Farm Press, received the American Soybean Association's Communications Award in the newspapers category at Soybean EXPO held in St. Louis recently.

The award is presented annually by the American Soybean Association, a farmer-controlled commodity organization working to build profits for soybean farmers.

In presenting the award, Soybean Association President David Haggard said, "In his six years with Farm Press Publications, Forrest Laws has excelled in his coverage of agriculture and of the soybean industry in particular. Forrest shares with his readers his understanding of the value of a strong soybean promotion program for both domestic and foreign markets. His articles also reflect his interest in the South American competition facing U.S. soybean farmers."

Remote sensors come of age

By T.J. BURNHAM
Farm Press Editorial Staff

PHOENIX, Ariz. — Use of remote sensors to replace the old eyeballing of foliage to determine whether plants need water, is "coming of age," says the USDA.

"Developments in the last 10 years allow us to quantify plant stress with stress indices," explained USDA-Agricultural Research Service water conservation laboratory scientist Robert Reginato.

With today's knowledge, farmers can turn from "touch and see" irrigation methods that lead them to turn on water when the plants felt too hot or looked wilted, explained Reginato.

"Today, we should be able to accurately assess plant stress and schedule irrigations to optimize yields by using measurements of foliage temperature, dry and wet bulb air temperature readings, and net radiation," he said.

New tools available

Although additional studies are needed to integrate these technologies, Reginato feels the new tools will soon be used to determine exact rates of water per irrigation.

The "when and how information, coupled with more efficient irrigation systems, will not only conserve water," he said, "they will also increase profitability of farming."

In fact, the techniques are designed as ways for the farmers to remain competitive, he told cotton producers attending the annual Western Cotton Production Conference here.

"We now know we can develop plant water indexing based on the foliage and air temperature and evaporation," he said. When using the new sensors to read such scores, growers are advised to take multiple scope scans in the center of the field.

Many growers are already using these infrared thermometers to take readings, observed Reginato, but too many are not checking the proper areas of their individual fields.

Another hint is to be sure the unit in use measures only the crop and soil temperatures, and not the ambient air at the same time. While both are needed, if air temperature is included in the crop-only reading, results will affect adversely irrigation.

When to water

While all this will help the farmer determine when to irrigate, new work is under way to help determine how much water the farmer should be applying, said Reginato.

"This system will never take growers out of the field, however," he noted. "The farmer will always need to go out there and see what is happening."

The CWSI (crop water stress index) developed in part by USDA still uses plant temperature as the basic ingredient in its formulation. Establishing baselines of irrigation using foliage-air temperature and evapotranspiration in the fields, the researchers found that requirements vary not only among crops, but also between various cultivars.

Using the baselines that depict well-watered and non-watered plants, an index is provided to calculate water stress. Charts that farmers may use indicate points at which to determine if a crop is stressed or not at various temperatures and evaporation levels.

With feeling

This supplements the "feeling" some use to guide irrigations, a method which isn't always accurate, said Reginato. "Even after irrigations that are suppose to take care of the plants, they may still be under some stress," he noted.

What the USDA and the University of Arizona is attempting to determine is the amount of stress that is allowable before yields decline — something the seat-of-the-pants irrigator finds difficult to determine.

SCHEDULER DEVICE for measuring plant moisture stress is displayed by Bronson Gardner, Standard Oil, developers of the instrument. Gardner discussed the system at a recent seminar on irrigation management at CSUF.

PRO-AG AGRONOMIST Jim Hill (above left), talks with Gwynn A. Sawyer, California State University, Fresno (CSUF) researcher, about her trials with controlling bunch rot on Chenin Blanc grapes with irrigation regime.

Infrared diagnoses plant stress in vineyards

By DAN BRYANT
Farm Press Editorial Staff

FRESNO, Calif. — A portable, plant stress monitoring device that offers greater simplicity over other types of equipment was discussed and demonstrated at the recent Vineyard Water Management Seminar at California State University, Fresno.

Known as the Scheduler and developed by Standard Oil Company of Ohio, it links a miniature computer with an infrared thermometer and sensors for air temperature, relative humidity and sunlight intensity. It can detect plant stress three to five days before crop yield is adversely affected.

The device, according to Charles Krauter, professor of irrigation at CSUF, is equal in sensitivity to a porometer, an expensive research tool that requires more time to obtain readings of plant stress.

The porometer, in turn, is more practical than the neutron probe, a stationary device that requires detailed calculations, and the pressure chamber, which can be operated only a certain times of day.

Chenin Blanc trial

Krauter researched the Scheduler, or IRT (for infrared thermometer), on drip irrigated Chenin Blanc vines in 1986. Water management on that variety is critical because of its susceptibility to Botrytis in conditions of excess moisture.

He also investigated use of the device on Thompson vines under drip and sprinkler irrigation plots and on 11 wine varieties and seven table varieties in 1987.

In the Chenin Blanc trials he found the IRT, used with various applications of water, registered stress with greater sensitivity to weather conditions than the porometer. After the experiment on the 18 varieties, he found no substantial difference that would prevent the IRT from being used on commercial vineyards.

"The IRT is as sensitive to plant stress as the porometer while more simple to operate and maintain than the other devices. It is designed to operate under field conditions and to handle a number of plots or fields quickly," said Krauter.

He cited its main difficulty with grapes in that weather conditions can affect readings from one day to the next, if there were a significant change in weather.

"The relative differences were still there between stressed and unstressed vines on all but the coolest days. If a known, unstressed vine is used as a reference and the indexes for the vines in question for that date are compared with the reference vine, then the IRT method can be used very well for stress management."

Bronson Gardner, in charge of Standard Oil's field trials of the Scheduler, said it is the first portable unit of its kind for determining crop stress. The $4,300 device has been used on many crops across the United States and is in its fourth generation since being released in 1986.

Although plants may undergo stress from over-irrigation, disease, insect damage, or nutritional deficiencies, in most cases the cause is a lack of moisture, Gardner explained.

To diagnose

"If there is sufficient available soil moisture, and the plant continues being stressed after an initial reaction to being watered, then you know there is another problem. In this instance, the Scheduler is being used as a diagnostic tool."

As a leaf picks up carbon dioxide and releases water, it is transpiring. Small pores on the surface of the leaf open or close to regulate this process. The pores close when the plant is stressed.

"As this transpiration slows, the leaf temperature rises, relative to the surrounding environment. The Scheduler measures those minute changes in leaf temperature and interprets them as the stress index."

The Scheduler has a battery-powered computer to both store information and provide a readout. Data for up to 30 fields can be stored during a 15-day period in its memory. A permanent record can be made by linking it to an external computer/printer.

Another presentation during the seminar was an account by Gwynn A. Sawyer, graduate research assistant, of her experiment this season on selective stress on drip-irrigated Chenin Blanc vines to control Botrytis.

She said when water was withheld during the lag phase of berry growth (stressing vines until veraison and then applying 50 percent of ET), bunch rot was controlled without harming chemistry of the fruit or yields.

Withholding water at veraison until harvest significantly reduced bunch rot and maintained yields, but it produced an undesirable effect by lowering the acid and raising pH levels of the berries.

In each of her treatments there was no significant loss in yields or detectable difference in sugar. Pruning weights and 100-berry weights were essentially the same throughout.

Next year's crop?

She said, however, "the most important question still remains through all this experimentation: what effect will the irrigation treatments have on next year's fruiting capacity?"

Keith Patterson, research scientist at CSUF's Viticulture and Enology Research Center, reported his observations of the relationship between water stress, vine physiology, and fruit chemistry.

Decreased moisture can affect vines by either inhibiting growth or closing stomates or pores of leaves through which oxygen and carbon dioxide flow in and out of the plant, he reminded.

"Severe water stress at the beginning of the season may affect the current year's production by reducing the number and size of berries, resulting in a smaller bunch weight," he said.

Floral buds

That same condition hampers vegetative growth and retards floral bud initiation which is reflected in future yields.

"When water stress is moderate and the rate of vegetative growth is within normal vigor of good commercial practice, floral initiation increases.

"When irrigation is in excess, floral bud initiation decreases due to excessive vigor. Shading within the canopy has been shown to have pronounced effects upon bud fruitfulness."

Patterson noted the effect of irrigation hinges on the interaction between vegetative and reproductive processes and the ability to regulate them through cultural practices such as pruning, training, and fertilization.

Irrigation can influence characteristics of berries such as excessive moisture causing shoot growth to compete with fruit as a nutrient sink. High water stress can delay maturity and interfere with desirable acidity, an element difficult to maintain in warm climates.

"Irrigation just prior to harvest has also been associated with dull, flat colors in dark varieties, and vegetative growth could compound the situation through shading and inhibition of anthocyanin formation. In addition, wines made from these grapes have been described as less 'fruity' and 'aromatic.'"

Patterson said further studies are needed to determine the effects of the relation between vine water and various must components.

Tensiometers and resistance blocks were compared in the talk by Dominic Pecchenino, CSUF vineyard manager. While the direct measurement of soil moisture can be made with lysimeters or gravimetric measures, these are both expensive and slow for the commercial grower, he said.

A range

"The indirect method of measurement is easier, more accurate, easily repeated, and affordable. It does not give an exact soil moisture content, but it gives a range of moisture available to the plant."

Tensiometers, the equivalent of plant roots, offer the advantages of permanent and easy installation at the root zone, good performance in sandy soils, and a working range of ten to 80 centibars. However, they do not work well in clay soils and measure only to -1 bar when the soil potential can go as low as -15 bars.

Resistance blocks, clay blocks carrying electrodes, function by measuring the resistance of the soil. They are economical and rapid to read with meters. They are easily installed, have little or no maintenance, and work well in clay soils.

On the other hand, Pecchenino said, they are limited to one year's use and are affected by salinity which influences conductivity more than moisture.

Papers presented at the seminar will be exchanged later by Vince Petrucci, director of the research center, at the gathering of the International Offices of Wines and Vines in Rome, Italy.

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169

VINEYARD NOTES

By T.J. BURNHAM
Farm Press Editorial Staff

This may be one you don't want to miss

Tips can be annoying.

Everyone is telling the vineyardist how to do his job these days. The guy on the next farm, the farm advisor, the salesman, the winery...

Tips can sink ships if they're on icebergs, but too many of them can drown a grower's interest just as fast. With today's rapid fire research results, who can sort out the good, the bad and the just plumb dippy?

But in the information cloudburst, it is the grower himself who must slosh to the surest suggestions. They must fit his needs, the specific requirements of his individual vineyard, to be of any real help.

With all of the meetings under way this season to dispense tips, how does the lone producer pick the ones just right for his kind of farming? It isn't an easy time, but neglecting all of the choices and continuing to farm in the same old way — taking the position that none of the new ideas are worthwhile — can allow the farm to fade into obsolesence.

Top gurus

It might help to focus on those gatherings that attract only the creme de la vino — the top names in vineyard technology. One such session is upcoming February 10 at UC-Davis. While it costs $75 for course materials, lunch and lectures, the menu of messages is impressive.

"We are offering growers some of the newest technology available to help them manage irrigation," says coordinator Daniel Roberts, a PhD at Sterling Vineyards (Napa Valley) who plugs the "Factors in Irrigation Management for Wine Grapes" as a four star must-attend winter confab.

"Everyone is talking about irrigation management today," said Roberts. "We're offering a chance to sort out the ideas, and provide the most clear picture of what might help growers under their individual circumstances."

All this is done, says Roberts, by breaking the program down into management ideas, and applying each to the state's widely varied types of land, climate and farming methods.

New unit

If nothing else, it would be worthwhile just to see how the new irrigation scheduler produced by Standard Oil works. "This is one of the latest ways to check your moisture in vines," said Roberts. "It measures vine and soil temperatures, solar radiation and relative humidity. All this is fed to its microprocessor which quickly calculates the vine crop stress index."

To the grower, this could mean quicker reaction to plant needs, and hopefully better yields and returns through actions that react to the causes rather than the effects of stress.

Sterling used the unit for six weeks in the Napa last August and September, says Roberts, and was impressed. "Overall, it gives the best view of what the vine is doing," he said.

But that's just the star of the show that will touch on the many other (and older) ways a grower can manage irrigation.

Mark Mathews of UCD will look at the latest information on the physiology of moisture stress in the vines;

Roberts will probe the importance of soil types and the individual needs of specific varieties;

Beringer Vineyards' Jim Frisinger will tell his success story using a variety of moisture sensing techniques at the Napa winery, ranging from weather stations to neutron probes.

There'll be specific experiences using the probe, pressure bomb and gypsum blocks by, respectively, Ron Brase, a Fresno consultant; UCD's Jason Benz, and Robert Mondavi's Ben Henry.

One instrument of intrigue which mea-

(See COURSE, pg. 28)

169

Course teaches better usage of irrigation

(Continued from Page 17)

sures the opening and closing of the stomates on the vine leaves, offers further enlightenment. "This is important," explains Roberts, "because when the stomates are closed, the plant is under stress. It is then that the temperatures rise and the vine can get into trouble."

Recognizing the symptom as it begins, the producer is allowed a chance to make corrections before calamity strikes.

"I think (irrigation) is an area so many researchers are involved in today that not all of the good information is getting out," said Roberts. "So many new ideas have come along, growers aren't even sure what questions to ask about them. Here's a chance to do so, and anyone who cares about quality or quantity of grapes can find something worth the time. Anyone who irrigates."

To learn more, call (toll free) 800-752-0881. Davis and Dixon residents should call 916-752-0880. The UC Extension course may be paid for using credit cards. Class time is 9 a.m.-4 p.m.

Crop stress now easily determined

Monitors simplify irrigation timing and increase yields

by Ron Brase

Since crop stress management is so important to ensuring good yields, crop management decisions have drawn heavily on our past experiences. During the past 10 years, we have used research-type instruments that measure crop stress.

One such tool is the plant pressure chamber, or "leaf bomb," — a basic tool used in research. The pressure chamber, however, is quite time-consuming to operate and therefore has not been widely adopted in production agriculture.

Infrared thermometry (IRT) to measure plant stress generally has been recognized as an "up-and-coming" technology. Until recently, however, IRT was just as time-consuming to operate.

Measuring the temperature of a plant's leaves is an effective means to determine stress. A primary reason a plant transpires moisture is to keep its leaves cool. If it didn't, its leaves would become as hot as the soil around the plant and the plant would die. If a plant has difficulty getting moisture from the soil (i.e., the soil is dry), the temperature of its leaves rises. So, by measuring leaf temperatures, we have a measure of stress.

The problem with previous approaches to IRT has been that the farmer or field consultant had to take several canopy temperature readings, use a calculator to determine the average, determine the relative humidity by taking the wet bulb and dry bulb temperatures, and then sit down with a series of charts to obtain a crop-stress index value. Determining the stress of a crop in the field would take upwards of a half an hour for data collection and evaluation.

Now a new IRT reduces that time to five minutes. In addition, it stores data for up to 30 fields. You can recall the last 15 days worth of data while you are in the field and make immediate decisions. This new IRT, called the Scheduler, has been developed by Standard Oil of Ohio, Engineered Materials Division.

Using the Scheduler, one can measure the temperature of crop leaves and simultaneously record conditions such as air temperature, relative humidity, and sunlight intensity — all through individual sensors. The machine immediately calculates a crop-stress index.

Corn, cotton, soybeans, wheat, alfalfa hay, barley and specialty crops such as cucumbers, leaf lettuce, grapes, green beans, potatoes, sugar beets and tomatoes all have been monitored in various commercial and university testing programs.

Our personal experience has been with cotton, processing tomatoes and premium wine grapes. Although it is important to understand the source of stress, the most important information is that the plant is under stress and must be relieved through irrigation.

We have used the Scheduler as a day-to-day work tool to help in scheduling irrigations and in a diagnostic mode where we want to locate "hot spots" in a field. We can isolate an area of poor growth in a field, determine what the problem is, then develop and implement a strategy to correct the situation.

In many of the field situations for which we provide production consulting services, we use the Scheduler to pinpoint crop-stress levels. When we know the precise level of crop stress, we then can measure the corresponding soil moisture level and integrate the result into our computerized soil moisture modeling program to refine our irrigation predictions.

Despite these advantages, there are some drawbacks in how IRT measures plant stress. For example, IRT is very reliable with full sunshine, but is less effective early or late in the day. This means data collection should be done between 11 a.m. and 3 p.m. This limitation is a topic of current research work, however. The mathematical relationships to account for less than full sunshine should be available soon. AF

Ron Brase is president of Crop Care Services Inc., a crop production consulting firm located in Fresno, Calif.

GOVERNMENT

FULL REGISTRATIONS

• EPA has approved a revised label for Riverdale Chemical's **Weedestroy AM40** amine salt product to include uses on fallowland, southern wild rose, irrigation ditch banks, and an expanded list of weeds.

• Griffin Ag Products Company has received federal approval of the use of **Meturon 4L** for preemergence and postemergence weed control in cotton. Meturon 4L is also labeled for preplant incorporation in Arizona and New Mexico.

• **Mavrik Aquaflow** pyrethroid is now available from Sandoz Crop Protection for insect control in Virginia pine and other conifers grown for Christmas tree and ornamental uses.

• BASF Corporation announces that a label expansion for **Basagran** herbicide now allows a tank mix of Basagran with 28 percent nitrogen solution in place of oil concentrate for improved control of velvetleaf in soybeans. Also allowed is a split application to increase consistency of control of eight broadleaf weeds in soybeans. The split application consists of 1 pint per acre of Basagran followed by a second application of 1 pint per acre 10–14 days later.

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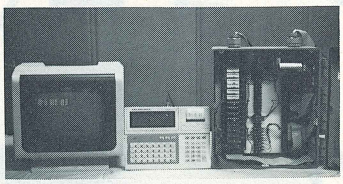

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BOOK REVIEW

Soil Erosion and Crop Productivity. R.F. Follett and B.A. Stewart, editors. American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, 677 S. Segoe Rd., Madison, WI 53711. 1985. 533 pages.

The Conservation Tillage Information Center indicates that some 99.6 million acres of cropland in the United States is under some form of conservation tillage. The center estimates this is 31 percent of the total cropland acres in production in our nation, an increase of almost 2 percent since last year.

Because soil erosion trends have an important impact on our agribusinesses, a good reference can help in future planning. The Agronomy, Crop Science, and Soil Science societies have provided us with such a readable reference. Seventy-nine contributors to *Soil Erosion and Crop Productivity* cover subjects ranging from an appraisal of the soil resources in the United States to a region-by-region examination of the effects of soil erosion on crop productivity.

Strong notice is earned by an Iowa farmer who says, "If soil erosion is controlled to assure sustenance for posterity, it will be because those who own and operate the land are motivated to conserve."

This is echoed by the secretary of agriculture, who says, "The real solution to erosion is going to be provided by the farmer—on his land. He's going to do it once he becomes fully convinced that conservation tillage and other improved tillage techniques are in his best interest. It will be in his interest because it keeps his land in place for his children. Or because if he wants to sell the land, it's going to sell for more. Or because he can make more money by using conservation tillage."

The book also includes useful background information for the frequent questions on increased perennial weed pressure that are brought up at conservation meetings. The book observes: "One principal reason for tillage in any cropping system is weed control. With the introduction of reduced- and no-tillage systems, weed control became a prominent consideration. Hence, the increased availability and use of a broad-range of herbicides are essential for economical crop production using reduced tillage systems."

E.E. "Ev" Waller
Executive Director, MACA

PRODUCTS

Plant Stress Monitor

Using an infrared thermometer, a built-in computer, and sensors for air temperature, relative humidity, and sunlight, a new 6-pound hand-held plant stress monitor is available from Standard Oil Engineered Materials. The Scheduler monitor is powered by a rechargeable battery and has a graphic readout showing the pattern of plant stress. Data for up to 30 fields during a 15-day period can be kept in the computer memory. The unit detects plant stress from any cause: lack of water, overirrigation, disease, insect damage, or nutritional deficiencies.
Circle 257 on Rapid Answer Service Card.

Pull-Type Spreader

TCI Tyler Inc. has a new 5-ton capacity pull-type fertilizer spreader. The unit combines the best features of the F4 series of spreaders with the capacity and strength of the 5-ton units, the company says. The body of the spreader is made of 304 stainless steel and will be produced in large manufacturing runs to reduce costs.
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ANDSCAPE
OF THE MONTH

T FLOWER (TECOMA STANS)

s a beautiful shrub which can be used to add during the summer months when it seems that

The plant is perennial but will be evergreen the location and the winter temperatures. lmost vining appearance, covered with bright s. The leaves are jade green, compound with d margin leaflets up to 4 inches long. The two rge clusters during the warmest months. The ved by slender bean-like pods 3 to 8 inches olerant of most soil types, but prefers amended Accepting part sun, the shrub prefers full sun, ing. In fact, this plant loves the heat, and posed walls will help to prevent cold damage. by temperatures below 28 degrees F, with le. The roots are generally hardy and rapid non. Heavy pruning would be recommended rn on new growth, so pinching will encourage d somewhat water-efficient, this shrub will mounts of water during the blooming period. 5 feet in one season possible. This makes the cellent choice for use as a border, screen, or

Infrared Devices May Be Used to Trigger Irrigation Systems

As efforts to save water in the Southwest increase, turf grass fields of the future may be spotted with highly sensitive infrared devices designed to detect turf stress and trigger irrigation systems only at optimum times.

A team of researchers at the University of Arizona Department of Plant Science recently finished the initial phase of a project designed to explore how these infrared thermometers could one day conserve water in the management of turf.

The team included David M. Kopec, Ph.D., an expert in turf and pasture grass, Donald Slack, Ph.D., an agricultural engineer, and graduate student H.J. Farahami.

During the past two years the team tested a range of infrared mathematical models designed to detect turfgrass stress over a series of soil moisture levels.

Kopec explained that turf temperature is important because as a leaf of grass dehydrates its temperature climbs indicating it is stressed and unable to cool itself through transpiration.

If this research is successful, the turf grass manager could use the infrared thermometer to detect temperature increases in turf and in essence, "the turf will tell its caregiver when it most needs to be watered."

The portable, lightweight devices resemble large water pistols and cost approximately $4,000.

"When turf is well watered and the air is hot and dry, then the turf will be cooler than the air. However, when the turf becomes stressed, the grass approaches the temperature of the air and under prolonged stress turf temperature will be higher," Kopec said.

As the researchers enter their next two-year phase, the team will attempt to determine the temperatures that indicate the optimum time to water.

The team's hope is that by using infrared thermometry, turf managers may be able to skip up to one irrigation in five. Kopec is quick to point out that this is only an estimate and that the method's conservation potential will not be known until the research is finished.

"When you detect the temperature of the turf is high and the plant is stressed, that is when you would irrigate, as opposed to the cut-and-dried cookbook method of irrigation," Kopec said, adding that the infrared device could be tied into a timer, allowing the grass to be watered when evaporation is at a minimum.

Infrared measurements on turf should be made at noon, the researcher said, cautioning that the device does not work well under prolonged cloudy conditions.

In future research the team will also look at the variables that would affect watering guidelines. They will measure stress levels of different grass species and study how varying cultural practices such as mowing and fertilizing would affect the proposed technique.

"When our research is over, we hope to see if the stress levels we select are accurate indicators of when the turf needs to be watered and if using infrared thermometry will allow for decreased water use in the long run," Kopec said.

Sierra Pumping Systems Inc.

Arkansas Gazette

Nielsen Ratings 4B
Small Screen 4B
Ann Landers 3B
Box Office Report 3B

Feature

Keith Patterson analyzes fruit with the Scheduler infrared radiation 'ray gun.' — Staff Photos by Steve Keesee

Idea is bearing fruit

High-tech gadgetry breathes life into trees

An apple's temperature is taken.

By Jerry Dean
GAZETTE STAFF

— GUY.

Not only humans feel "stressed out" in the oppressive August heat.

Hey! It's no picnic out there if you're an apple tree, either.

Fruit trees are as susceptible as anything to heat stress.

Unless they're among the fortunate few trees growing amid a climate-controlled orchard at Cadron Crest.

For a decade now, Carroll and Janet Barclay have been determined to transform a hardscrabble former cotton field into a productive, 35-acre "you-pick-'em" orchard. It's a mile off state Highway 25, north of this Ozark foothills town of 250.

Dozens of pickers — some from a nearby Senior Citizens Center — recently busied themselves amid 12 acres of peach trees, filling pokes with sweet summer abundance. Intent on choosing the juiciest fruit, most were oblivious to high-tech fruit-growing methods being used in a nearby apple orchard.

The Barclays, New Jersey transplants, are combining long experience as producers with scientific methods to optimize crop irrigation. Besides peaches, their orchard boasts 16 acres in apples, three in blueberries and rows of tantalizing nectarines.

Keith Mode, an orchard supervisor, demonstrated an overhead irrigation system whose elevated nozzles not only supply water to thirsty tree roots, but also cool the air, easing stress on ripening fruit.

"Thermister" electronic sensors, implanted in certain apples, measure heat within the fruit, where it's up to 20 degrees hotter than surrounding air.

When a computer, comparing fruit and air temperatures, senses a need for cooling moisture, a circuit closes. That triggers an electric pump.

And 90 overhead sprinklers leap to life, adding to the air either droplets or a refreshing mist. Temperatures drop. A gentle breeze is spawned out of no-

(See ORCHARDS on Page 2B.)

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ıs, but it isn't. We
do not see ourselves as treating an illness. Our participants voluntarily take advantage of the opportunities we offer."

In deciding which programs to sponsor, Ounce looks at potential impact on the community.

"Even if services are limited, we know it's essential that any program of ours work with others in the larger community," Carter said.

One of the biggest changes Carter has seen is the Ounce's impact on the state system.

"We don't have to convince legislators anymore that prevention is important. They understand it now."

Carter said the program has been fairly successful in delaying a teen-age mother's second pregnancy. "All the statistics indicate that her problems compound enormously with the birth of that second baby."

She adds that peer relations and sex education programs in urban schools have dramatically decreased pregnancies in targeted schools.

"Pregnancy, drugs and alcohol in adolescence are symptoms of a lack of information and poor self-esteem," Carter said. "Parents need to create an environment where their children can ask questions. And they shouldn't be appalled by the things they say."

She adds that boys in Ounce programs like to talk to men who listen but who also don't let them get away with anything. "Teen-agers thrive on structure where expectations are clear."

(Dr. Irene Beck is director of program development at the Sheppard Pratt Health System Education Center in Baltimore. If you have a question or would like more information, write to Dr. Irene Beck, Education Center of Sheppard Pratt, P.O. Box 6815, Baltimore, MD 21285-6815.)

Orchards

Continued from Page 1B.

where.

Dr. Keith Patterson, Extension horticulturalist for the University of Arkansas at Fayetteville, moved among the trees, aiming what resembled a ray gun at a few.

His "gun," a $4,900 Scheduler plant stress monitor, senses infrared radiation, then feeds data on humidity, sunlight intensity, leaf and air temperature into a computer carried in a shoulder pack. The data, once analyzed, profile plant stress levels.

The Scheduler, developed in California by Standard Oil Engineered Materials Co., uses U.S. Agriculture Department research indexes. It's calibrated for use with crops from alfalfa to wheat, including beets, cotton, corn, cucumbers, grapes, melons, oranges, potatoes, sorghum, soybeans, tomatoes — even turf.

Patterson, using the gadget on apples, is working out a new stress index for that crop. He's also used it in blueberry tests at Fayetteville, much as he did in Fresno State University wine grape research in California's Napa Valley.

Barclay and Mode set into their irrigation system a temperature apples must tolerate before the system, working like a home thermostat, begins cooling air.

Patterson, to show irrigation's impact, measured a tree's leaf temperature at 87 degrees. Minutes after irrigation began, the reading dropped to 85. Tensiometers, buried at intervals throughout the orchard, also measure soil moisture.

As summer progresses, irrigation increases up to 14 hours daily. The system applies 250 gallons a minute.

"Our trees don't even know a drought's going on," Barclay smiled.

The trick, he said, lies in balancing yield with irrigation costs. It takes electricity to pump more water.

"Efficient water usage will be the 1990s watchword," Patterson predicted. Orchards now, he said, are often at the weather's mercy. Altering the environment makes yield more dependable.

"We're creating a favorable environment," Patterson said. "Hopefully, without sacrificing something else."

But such irrigation doesn't come cheap. Barclay's one-time cost was $2,000 an acre, he said. So growers won't stampede to install similar systems until most are assured it will mean improved yield, quality and marketability.

For now, the idea may be ahead of its time. At least it's already bearing fruit for Cadron Crest Orchards.

Other Days

Gazette Files

50 Years Ago

(August 4, 1938)

To the Editor of the Gazette:

The Arkansas Conference for Social and Economic Progress that was held July 23rd in the Y.M.C.A. has been a bombshell of surprise to many futilitarian prophets, and it has given many of the more optimistic of us the opportunity to say: "I told you so."

We have been claiming that Arkansas was rich in liberal progressive sentiment. The conference should have proved it to the most skeptical. The attendance was beyond expectations. The enthusiasm was as striking as was the unusual agreement in opinion. It was clear that Arkansas people are not apathetic and that they are not so confused about issues in which they are vitally concerned. They can and will do more than "just talk." The conference indicated that the people in general are squarely behind the program and policies of the president, and that they are resentful of those office-holders who were elected as Roosevelt supporters, yet sabotaged everything progressive that the administration stood for.

Anyone present at the conference would have realized that progressive and liberal elements in organized labor, small farmers, small home owners, professional and church groups are only too glad to combine and organize to defend those democratic principles they hold in common.

John Doe in Arkansas is no longer content to merely to grumble to friends and relatives about the disheartening concessions he must inevitably make to enthroned privilege and its financial and political power.

'People meter' people pulling plug on U.S.; Murphy, Hall reteam

Entertainment Briefs

Gazette Press Services

GB Television Research is

'Wanda'

Continued from Page 1B.

that asks the question: Can [illegible]

New Irrigation Management Tool

A plant stress reading is taken by pointing the Scheduler plant stress monitor at a crop's leaves or canopy.

Standard Oil Engineered Materials Company has introduced the Scheduler™ plant stress monitor for detecting crop stress in order to simplify irrigation scheduling.

Using an infrared thermometer, the Scheduler reads the temperature of crop leaves or canopy; it also records atmospheric conditions and then calculates plant stress levels. In addition to stress due to a lack of water, the unit can inform growers of other stress factors including disease and insect damage.

"If a plant is under stress, its leaf temperature rises in relationship to the environment, and the Scheduler detects this change," explained Steven C. DeSutter, marketing manager. "When the stress index reaches a predetermined point, the grower knows to irrigate and avoid yield loss; and reduces his risk caused by improper irrigation timing."

DeSutter noted that the monitor was field tested during the last two years and proved to be an economical irrigation management tool.

"Our researchers determined how to put several delicate scientific instruments into a six-pound package and make it durable and practical for in-field use," he said, adding that the original prototype assembled in 1984 weighed 25 pounds.

"The Scheduler detects a plant that is not transpiring at an optimum rate. This plant is under stress," said Standard Oil's Dr. Bronson Gardner, one of the product's developers and scientist in charge of field trials. "A majority of the time, it is simply stress due to the lack of water, which indicates the need for irrigation, but there are times when the plant will undergo stress due to over irrigation, disease, insect damage and nutritional deficiencies.

If there is sufficient available soil moisture, and the plant continues being stressed after an initial reaction to being watered, then you know there is another problem. In this instance, the Scheduler is being used as a diagnostic tool," Gardner said.

As carbon dioxide enters a leaf and water evaporates from the leaf, the plant is transpiring. The small pores on the surface of leaves (stomata) regulate this transpiration by opening and closing. The stomates constrict or completely close when the plant is under stress and this slows or stops transpiration.

As transpiration slows, the leaf temperature rises (relative to the surrounding environment). The plant stress monitor measures those minute changes in leaf temperature and interprets them as the stress index.

The Scheduler contains:

Infrared thermometer for plant canopy temperature readings;

Individual sensors to determine air temperature, relative humidity and intensity of sunlight;

Computer to calculate the crop stress indexes from the sensors;

LCD display panel designed for use in bright sunlight;

Compatibility for connecting to IBM compatible computers and serial printers;

Rechargeable, battery-operated power supply;

Lightweight and rugged weather-tight packaging.

Field trials using the Scheduler have been completed for alfalfa, barley, corn, cotton, cucumbers, leaf lettuce, grapes, green beans, potatoes, soybeans, sugar beets, tomatoes and wheat. Work is proceeding with other vegetables, citrus and almonds.

For more information, contact Norbert J. Forness, Standard Oil Engineered Materials Company, Carborundum Center, Niagara Falls, NY 14302, 716/278-2781.

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HOW THE SCHEDULER™ MONITOR DETECTS CROP STRESS

Irrigation has traditionally been scheduled according to factors that are lacking direct crop measurements. However, research scientists from Standard Oil Engineered Materials Company determined that irrigation scheduling could be more efficient when the crop tells growers when to water. Leaders from the irrigation industry agreed and encouraged these R & D scientists to pursue this effort.

Starting with this concept, the scientists developed the Scheduler™ plant stress monitor, a sophisticated but easy-to-use tool that allows maximum efficiency in scheduling irrigation.

The Scheduler is the first portable unit of its kind for determining crop stress. A computer calculates plant stress from inputs provided by an infrared thermometer and sensors for air temperature, relative humidity and sunlight intensity. Plant stress is detected 3 to 5 days before crop yield is negatively affected.

"The accuracy of the Scheduler has been proven by years of field testing and use at more than 30 sites across the nation," said Standard Oil's Dr. Bronson Gardner, one of the product's developers and scientist in charge of field trials.

"The Scheduler detects a plant that is not transpiring at an optimum rate, this plant is under stress," Gardner explained. "A majority of the time, it is simply stress due to the lack of water, which indicates the need for irrigation, but there are times when the plant will undergo stress due to over irrigation, disease, insect damage and nutritional deficiencies.

"If there is sufficient available soil moisture, and the plant continues being stressed after an initial reaction to being watered, then you know there is another problem. In this instance, the Scheduler is being used as a diagnostic tool," he said.

As carbon-dioxide enters a leaf and water evaporates from the leaf, the plant is transpiring. The small pores on the surface of leaves (stomata) regulate this transpiration by opening and closing. The stomates constrict or completely close when the plant is under stress and this slows or stops transpiration.

As transpiration slows, the leaf temperature rises (relative to the surrounding environment). The Scheduler plant stress monitor measures those minute changes in leaf temperature and interprets them as the stress index.

Although the Scheduler is an extremely compact unit powered by a rechargeable battery, the unit contains a powerful yet simple computer program to calculate the crop stress, provide a readout and store information. A graphic readout shows the pattern of plant stress as it develops. Data for up to 30

individual fields during a 15-day period can be retained in the Scheduler's memory. By linking to an external computer/printer, a permanent record can be retained or a data base established.

The Scheduler is programmable for numerous crops. Stress indexes are developed for each crop because different plant species relate to the environment differently. "For each crop we have to know the "base-line" or normal reading for a non-stressed crop," Gardner explained. "Departures from that base-line indicate some type of stress. Once the plant stress has increased to a predetermined level, irrigation needs to begin.

"Depending upon the crop", he added, "growers may want to provide a certain amount of stress at specific growth phases, or provide extra irrigation at points critical to crop yield. The bottom line is that the Scheduler gives growers flexibility in managing their crops never before available."

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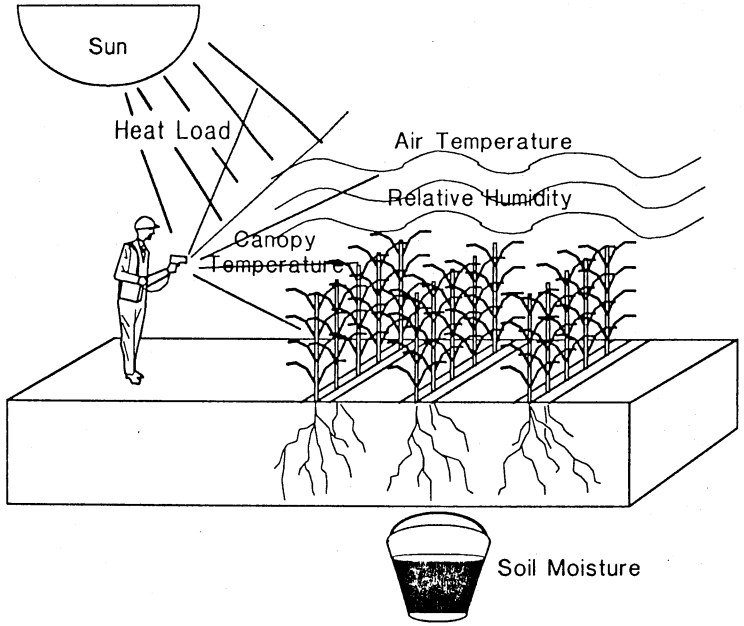
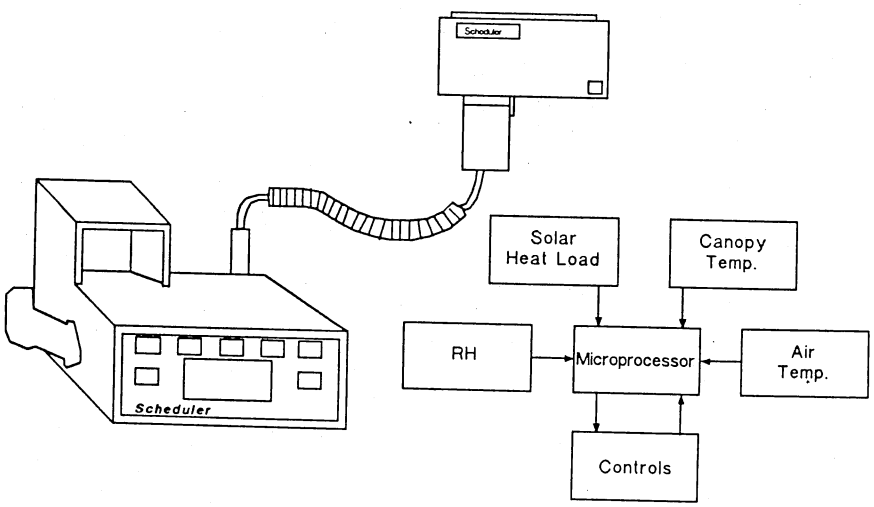


IN A FRACTION OF A SECOND THE SCHEDULER™ COMPUTES PLANT STRESS FROM INFRARED CROP CANOPY TEMPERATURE AND ENVIRONMENTAL CONDITIONS



THE SCHEDULER™ IS A COMPACT UNIT THAT REPLACES SEVERAL INDIVIDUAL SCIENTIFIC TOOLS IN CALCULATING PLANT STRESS

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RESEARCHERS DESCRIBE IMPROVEMENTS
IN CROP IRRIGATION MANAGEMENT

Economical irrigation scheduling is now possible with a new compact portable electronic unit that measures plant stress. The unit is the Scheduler™ plant stress monitor developed by Standard Oil Engineered Materials Company.

"The Scheduler is very fast on data collection and gives you a good representation of the plant's state-of-health or degree of stress," said Ron Brase, agricultural consultant with Crop Care Services, Fresno, Calif.

University researchers around the world have known that infrared thermometry readings of plant foliage indicate when a plant is under stress. And farmers who irrigate have been finding that efficient, precise scheduling of irrigation can result in water savings, improved crop yields and higher quality crops.

What was not possible before the Scheduler was a way to easily correlate infrared and atmospheric readings with efficient irrigation timing. The plant stress was computer-calculated after separate readings were taken by expensive ($7,000-10,000) scientific equipment. The Scheduler has a built-in computer to do the calculations automatically from readings taken by the unit's infrared thermometer and individual sensors for air temperature, relative humidity and sunlight intensity.

"The Scheduler is one of the fastest, most accurate field tools that we've ever used, and we've used just about every tool that has been on the market. When you couple the Scheduler with a good irrigation scheduling computer program to give precise irrigation amounts, you have an unbeatable combination for maximum profits," Brase said.

Brian Barelmann, foreman for the Herd Company farming operation at Bartlett, Neb., said of the unit's user-friendliness: "It took me about 15 minutes to learn how to use the Scheduler."

Barelmann used a Scheduler to monitor stress on corn under center pivot irrigation in the sand hills region of Nebraska. He said the unit determined that he was over-watering some corn and under-watering other corn.

"The toughest part about farming this land is to schedule watering because the soil's holding capacity is so low. It dries out so fast that everyone has assumed you can't get your pivots around fast enough to keep the crop from being stressed. What we really found using the Scheduler is that we were actually over-watering our sandy circles on the hills and under-watering our lower land, higher quality soil," Barelmann said.

Brase has used the Scheduler to determine irrigation schedules for cotton, alfalfa, sugar beets, tomatoes and wine grapes. "When you are able to measure the stress that a plant is under, you don't really know whether the stress is caused by a lack of water in the ground, disease or a nutritional problem," he said.

"Although it is important to understand the source of stress, the most important thing is realizing that the plant is under stress. Usually the only immediate solution is providing some additional soil moisture," he added.

If the plant does not respond to irrigation, appropriate additional measures can be taken. Because the Scheduler detects a problem early, action can be taken before the plant shows visual signs of disease or lack of nutrients.

Most methods for determining when to irrigate crops are based upon soil moisture. Blaine Blad, professor of agricultural meterology at the University of Nebraska, said, "The Scheduler allows the plant to tell you when it needs water." Blad has been using infrared thermometry for several years to determine when plants need the water.

More efficient use of water is one goal, he said. "Some farmers may be putting on too much water, and others may not be putting on enough." Better scheduling of irrigation can translate into a higher yield and more efficient crop production.

A large number of farmers who irrigate are over-watering, said Wayne Shawcroft, Colorado State Extension Irrigation Specialist. He notes that on average each revolution of a center pivot applies about one-inch of water to the crop. For irrigated field corn in northeastern Colorado, the normal has been for 18- to 24-inches of water to be applied in a growing season.

By using scheduling techniques, farmers have been able to cut their water application by four to six inches or by about 20 percent. The savings will vary from crop to crop and field to field, he suggested. Because soybeans require less water than corn, the potential savings from efficient scheduling might be more like 10 to 15 percent, he added.

Shawcroft also suggested another benefit from efficient scheduling, especially with sandy soils. "There is less nitrogen washed out using irrigation scheduling." As excess water soaks away, it takes water soluable soil nutrients with it.

With some crops, stressing the plant at the appropriate time will improve the quality of the crop and reduce the amount of disease. Premium wine grapes is one high value crop for which this is known to be true.

Extensive testing of the Scheduler for irrigating wine grapes has been conducted in California and Washington. Dr. Charles Krauter, irrigation specialist at California State University, Fresno, is in charge of a current project to determine how to reduce or eliminate botrytis rot (bunch rot) by properly scheduling irrigations. Appropriate stressing of a vine early in the growing season, the research determined, causes the plant to not form as tight a cluster. If the cluster is too tight, some of the grapes rupture and become a breeding ground for fungus. This eventually ruins the entire cluster.

"Without the Scheduler, we wouldn't know when to stress the vines or by how much," Krauter said. "It does a wonderful job of monitoring the stress, and the only thing comparable to it is a delicate research-type device that costs twice as much as the Scheduler."

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ST27™ TURF MONITOR IS NEW TOOL FOR IRRIGATION

Niagara Falls, N.Y., August 27, 1987 -- Standard Oil Engineered Materials Company introduces the ST27™ Turf Monitor to simplify irrigation scheduling.

For the first time, a golf course superintendent has a tool that allows him to make watering decisions based on the turf's actual need for water. This can result in lower watering costs while still maintaining top quality turf. The ST27 Turf Monitor also detects turf stress before it can be visually detected to help keep grasses lush. Monitors for municipal and industrial applications will soon be available.

The monitor uses an infrared thermometer to measure turf temperature and environmental sensors to measure air temperature, humidity and solar radiation. A lightweight shoulder-pack computer automatically calculates the condition of the grass based upon all the measurements. "The ST27 Turf Monitor measures current turf conditions, charts past turf conditions and allows for predicting future water requirements," explained Korbin Riley, marketing manager, Sensor Technologies Group, Standard Oil Engineered Materials Company.

"Even though the monitor's computer is doing complicated calculations based upon the data it collects," Riley said,

"the operator doesn't need computer knowledge or special training. It is extremely easy to operate."

"If grass is under stress, its leaf temperature or canopy temperature rises in relationship to the environment, and the monitor detects this change," Riley says.

The ST27 Turf Monitor has the capacity to maintain records for up to 135 areas of a golf course including tees, greens, fairway, rough or any other special areas. This is capacity sufficient for 27 complete holes.

In addition to allowing efficient watering, these records help the superintendent to identify problem areas where application timing of herbicides, insecticides and fungicides can be improved. Using the monitor gives the superintendent immediate feedback on syringing and other irrigation applications. This results in consistent turf from green to green and fairway to fairway.

The monitor's data can be transferred to personal computers. The information can be printed for a permanent file allowing superintendents to trace year-to-year stress trends for better turf managements. Irrigation models and custom programs can be developed from the data to improve the course or more easily maintain it in top competitive form.

For more information about the ST27 Turf Monitor contact: Standard Oil Engineered Materials Company, Sensor Technologies Group, 6180 Cochran Road, P.O. Box 391316, Solon, Ohio 44139; 216-349-6881.

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CAPTION:

The ST27™ Turf Monitor detects turf stress before it can be visually detected and allows making watering decisions based on the turf's need for water.